Global Pan Inc., Japan

PROPOSED INNOVATIVE OPTICAL CABLE SOLUTION FOR CLOSING THE URBAN-RURAL DIGITAL DIVIDE

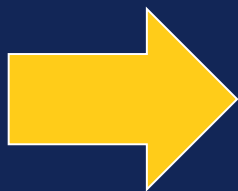|		
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Innovative Optical Cable Solution for closing the urban-rural digital divide

APT/ITU Conformance & Interoperability Event
8, Sept. 2015
Bangkok

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Trends in Mobile Handsets
Mobile Phones to Smart Phones & Tablets

BB is must in e-Diagnosis e-Education

2013
Population   7.3 B
Mobile Phones   6.4 B

>256 kbps
Developed Countries 51 %
Developing Countries 8 %

2018
Population   7.5B
Smart Phones   4.5 B

Definition of "Broadband"
  US FCC : 25/3 Mbps (2015)
  EU digital agenda (by 2020)
     : 30 Mbps(100%)
     100 Mbps(50%)

Download time 45 min TV (200 MB) : 1min.@25 Mbps – 25 min.@1 Mbps

Broadband Backhaul is "MUST" From Cities to Rural Areas

Wired vs Wireless

Trunk Line

<1 Gbps Few kms each

>1000x1 Gbps >100 km

LTE, 4G

Base Station for Mobiles

CAPEX Comparison
Wireless vs Wired (US$)

Microwave solution (18 GHz, 100 Mbps)
Civil Works :   10,000-30,000 $
Equipment :   25,000-50,000 $
(per a pair of antenna, equipment @ every few Kms)

Optical cable solution
Civil Works:
 Shallow burial(Bhtan)   ~1,000$/km
 Aerial wiring(Jp)   ~20,000$/km + pole
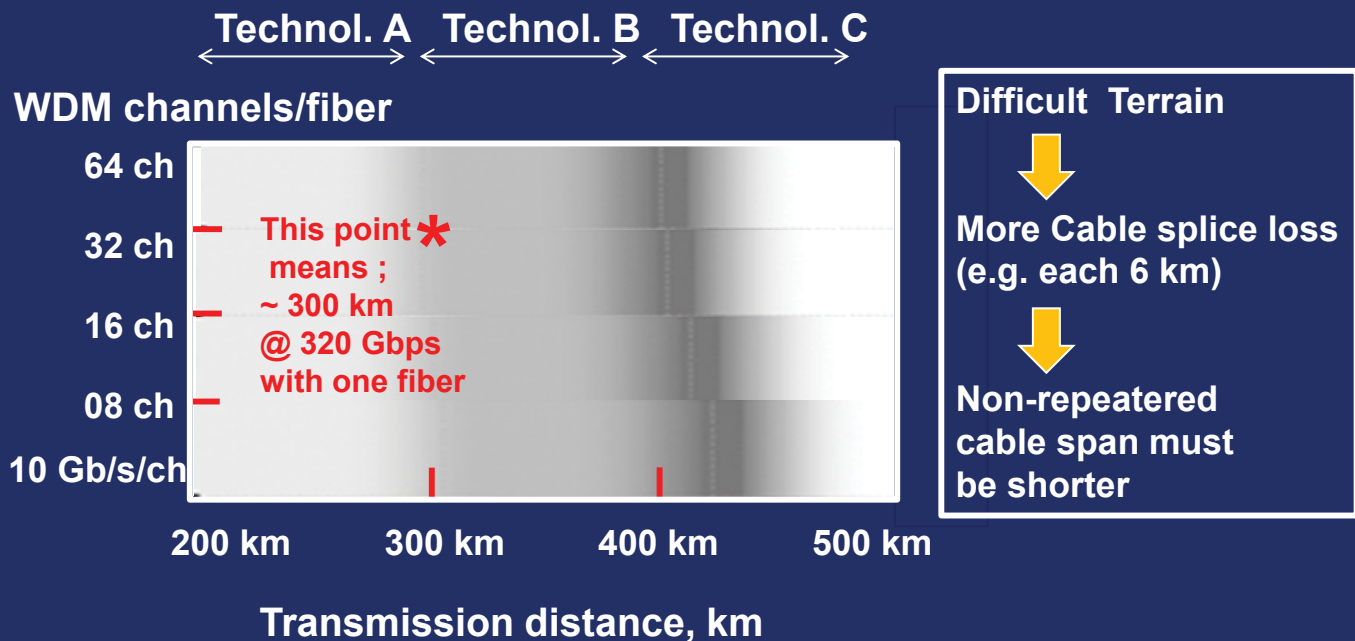 Deep-Buried pipe(Korea) 71,800$/km(with manhole/pipe)
Cable   <1000-4000$/km (+ α: connecters)
Equip't (media coverter) <200$/km (20k$/10Gbpsx100km:33dB

Optical Cable Solution
Signal Capacity vs. Transmission Distances
without demanding Electric Power Supply

Technol. A   Technol. B   Technol. C

WDM channels/fiber

64 ch

32 ch — This point ✱ means ; ~ 300 km @ 320 Gbps with one fiber

16 ch

08 ch

10 Gb/s/ch

200 km   300 km   400 km   500 km

Transmission distance, km

Difficult Terrain

⬇

More Cable splice loss (e.g. each 6 km)

⬇

Non-repeatered cable span must be shorter

Estimated cost of Cable + Construction
Shallow direct burial using a handy pick

Cable with steel pipe with/without armor wire
8-11 mmΦ   3~4,000 US$/km
（+ α if connecterized）

Construction
・300m/day by 10 local people
・labor wage : < 50 US$/day/head

Total 4500 – 5500 US$/km or less (+ α)

Min. CAPEX/OPEX available with Opt. Solution
if direct-surface installation is allowed
with later burying, submerging and suspending

Difficulties in wireless solution

Construction cost:	high
Data rate:	< 1 Gbps
Antenna spacing:	< few Kms
Power:	80-90% Diesel engine
	for Rural mobile towers
	with 9k L fuel/Y per tower

P.K.PANIGRAHIm,
Ex Sr.DDG, DoT
India

Hasty introduction of microwave solution
might slow down the Nation-Wide Broadband plan

ITU-T develops a new Opt.-cable Standard
for direct surface installation –proposal

INTERNATIONAL TELECOMMUNICATION UNION

COM 15 – C 1091 – E

TELECOMMUNICATION
STANDARDIZATION S

STUDY PERIOD 2013-2016

Nov. 2014

Question(s):	16/15
	STUDY GROUP
Source:	Global Plan Inc.
Title:	Proposed Annex A of Rec. A.1 for optical fibre cables for direct surface application with its Draft ITU-T Recommendation

1. Introduction

The goals of the World Summit on the Information Society (WSIS), which are aligned with the United Nations Millennium Development Goals (MDGs) and the WSIS targets of connecting all villages, towns and cities, can be achieved in Developing Countries through infrastructure capacity building.

The objective of ITU-T for producing global standards(2012-2015) identified in Resolution 71 of PP 2010 as the very first ballot item is "to develop standards consistent with ITU's mandate and the needs and interests of the membership, such as narrowing the digital divide, improving health and safety ...."

ITU strategic plan (2016-2019) states nearly two thirds of the world population still have no regular access to the Internet. The infrastructure challenge to connect all of these people to high-speed Internet is enormous. Its Goal 2 is "Bridge the digital divide and provide broadband for all": the broadband defined by US FCC in 2015 is 25 Mbps(down-stream)/3 Mbps(up-stream).

To connect cities and rural/remote areas toward closing the digital divide, although wireless solutions are often used today, optical-fibre solutions are also very important to quickly and nation-widely penetrate ultimate broadband even across difficult terrain.

ITU-T develops a new Opt.-cable Standard for direct surface installation –Now started

Jun. 2015, agreed to develop new cable standards

Proposal for New Recommendation *"Optical Fibre Cables for Direct Surface Application".*

C1402 "Inputs for discussion of optical fibre cable Recommendation for direct surface application" was reviewed. Low cost, reliability and robustness were proposed as the most important requirements. It was noted that the key proposal in this contribution was direct surface application with manual cable laying in a do-it-yourself manner on a cable with continuous metallic barrier. It was also noted that optical cables have been proven to be rugged and robust. They would survive the conditions described in the three contributions.

WD16-01 Annex A1 Justification for ITU-T L.dsa (Direct Surface Application) was reviewed and accepted with revisions (**Attachment 1**).

WD16-02 Annex A1 Justification for ITU-T L.cci (Criteria for Optical Cable Installation) was reviewed and accepted with revisions (**Attachment 2**).

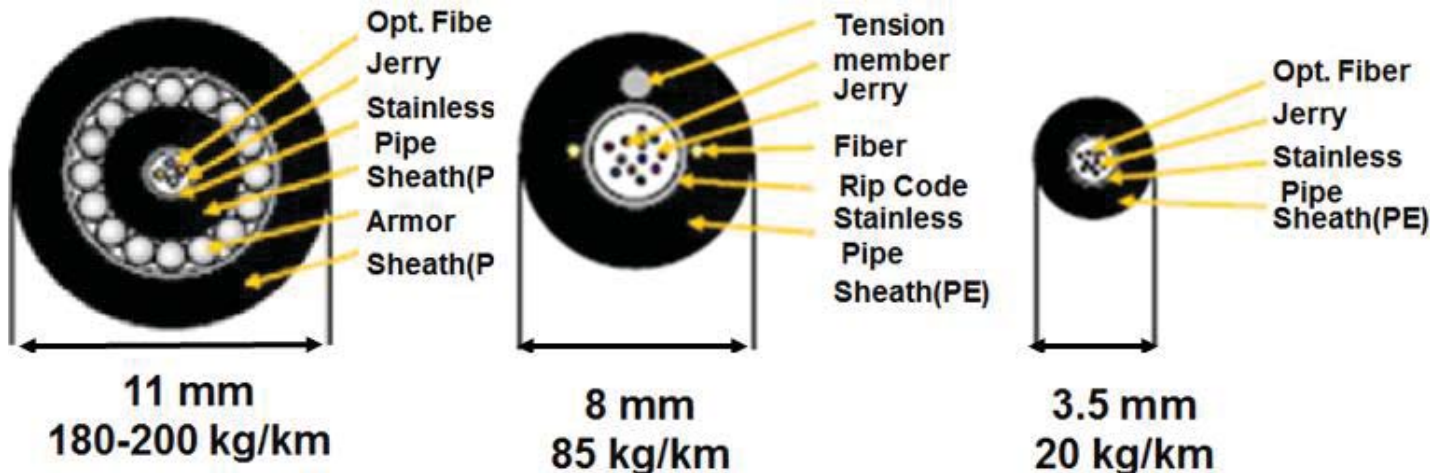# Innovative optical cable with a steel pipe allowing direct-surface installation

PE Jacket Φ11mm

Steel Armor Wire

Stainless-Steel Pipe with optical fibers

Outer diameter	Φ11 mm
Tensile Strength	350 kg
Lateral pressure	>500kg/100mm
Weight	180-200 kg/km

Three Cable Types
Commercially available, Japan

Opt. Fibe
Jerry
Stainless
Pipe
Sheath(P
Armor
Sheath(P

11 mm
180-200 kg/km

Tension
member
Jerry
Fiber
Rip Code
Stainless
Pipe
Sheath(PE)

8 mm
85 kg/km

Opt. Fiber
Jerry
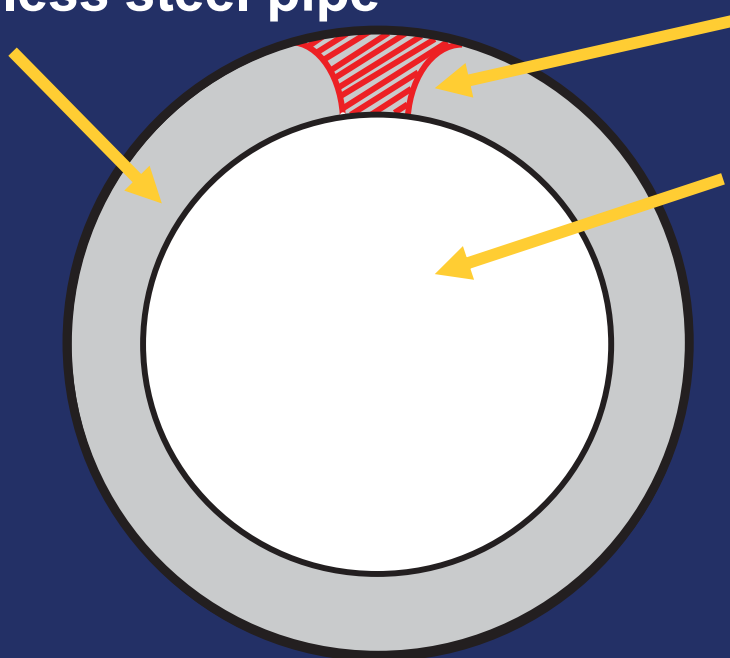Stainless
Pipe
Sheath(PE)

3.5 mm
20 kg/km

20 Years, 20,000km

Cross-section of the stainless-steel pipe

Stainless steel pipe

Welded region
(Completely water-proof)

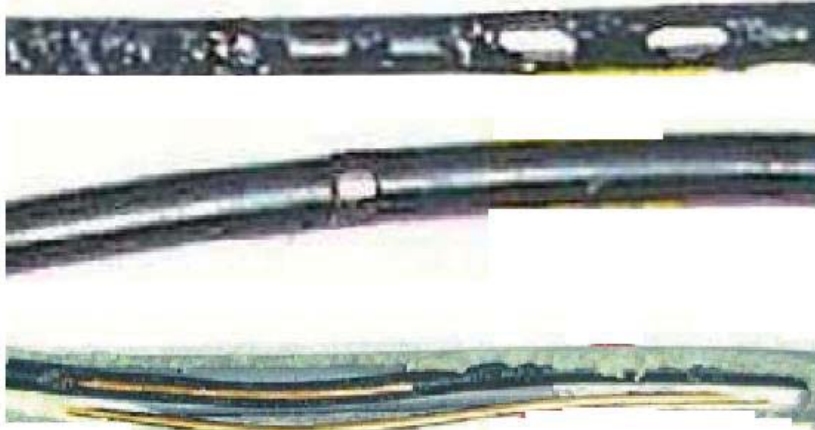**Example of Number of Optical Fibers acceptable in the pipe**

In the pipe used
for 11mmΦ cable
  $\leq$6X4 fiber-ribbon or,
  $\leq$48 loose fiber
for 8mmΦ cable
  $\leq$3X4 fiber-ribbon or,
  $\leq$24 loose fiber
for 3.5mmΦ cable
  $\leq$1X4 fiber-ribbon or,
  $\leq$8 loose fiber

Rodent Proof Test (Rats)

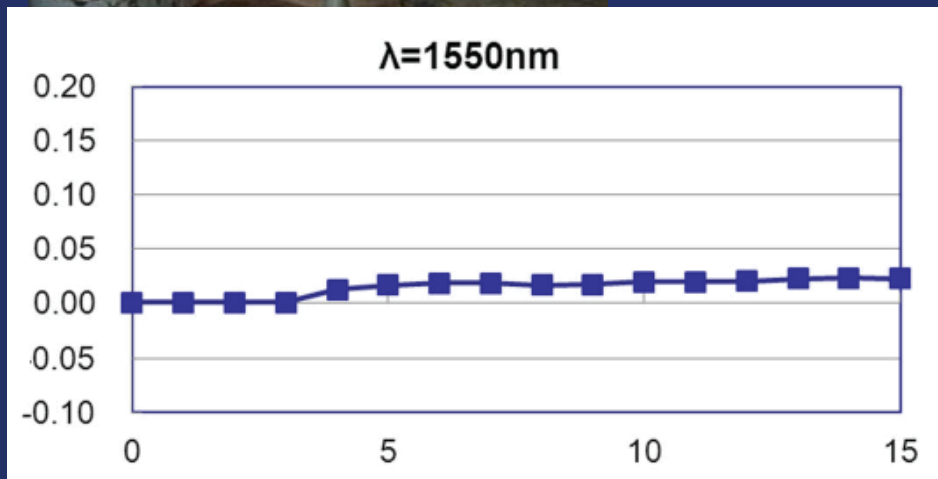After 6 days with
 4 Brown Rats
 4 Roof Rats

Steel-pipe Cable
Fibers protected

Conventional
Cable
broken

# Fire Proof Test at 1180 ℃

Optical Loss Increase, dB

λ=1550nm

minutes

# Lateral-pressure proof test

Optical loss increase, dB

Loss Increase Allowa...

Fiber#
1
2
3

200kg/100mm

Steel-pipe Cable, 3.5 mmΦ

kg/100 mm

Suspended-cable vibration test

No damage was observed against simulated cable vibration for aerial wiring, 10^6 times

Cable clamp

0.5m   0.5m

1m

Cable

Optical Fiber

Shaker
10 Hz, 5 mm p-p
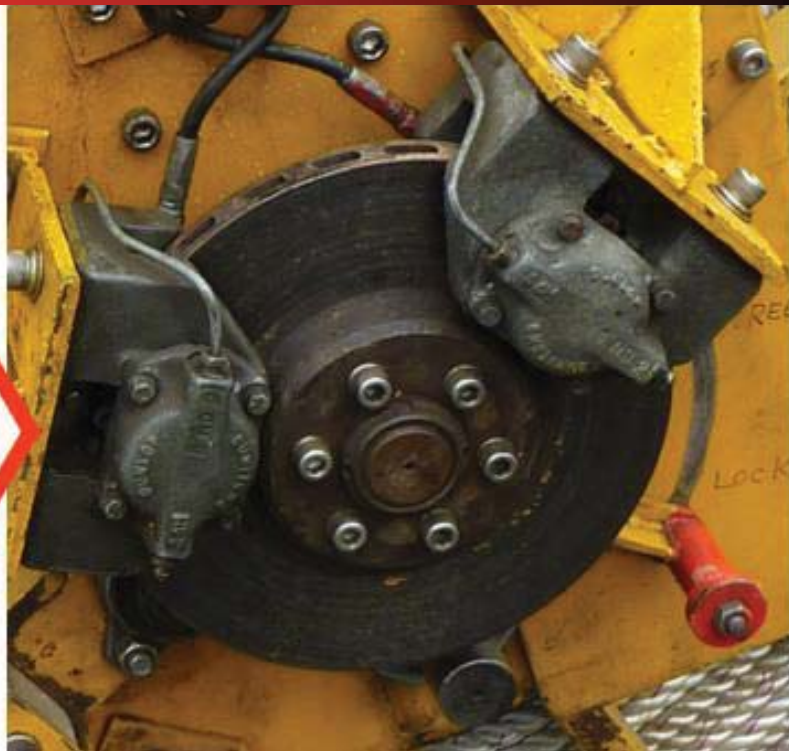10^6 times
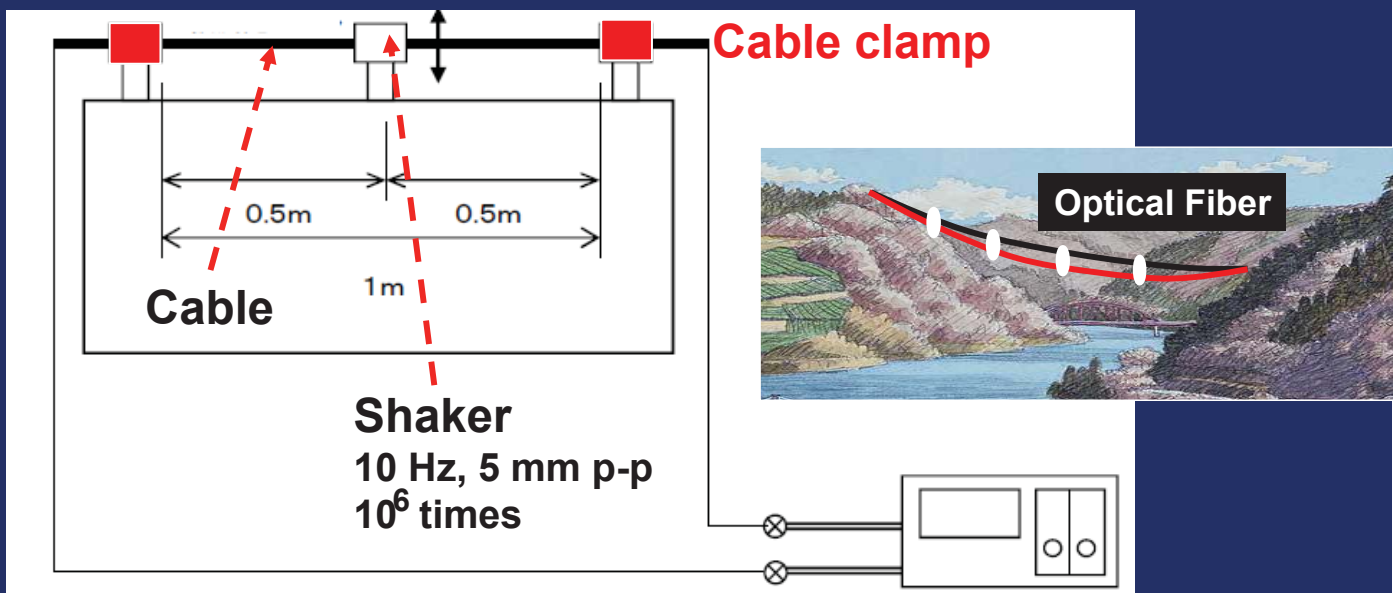
Water Proof, **Proven**

Thin and Lightweight Cable
Cost-Effective Easy Cable Laying Enables "Do it yourself"
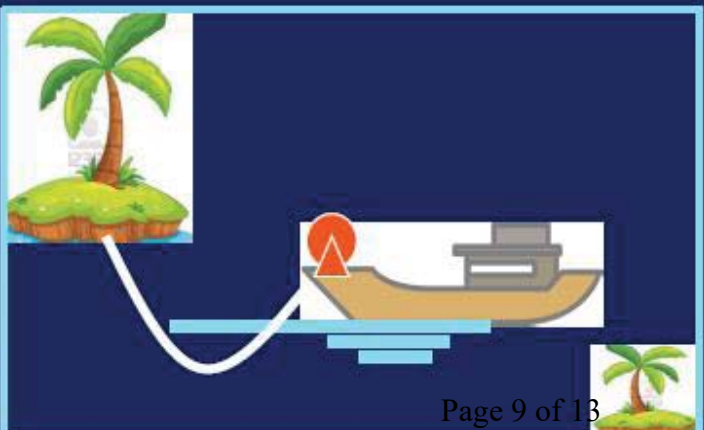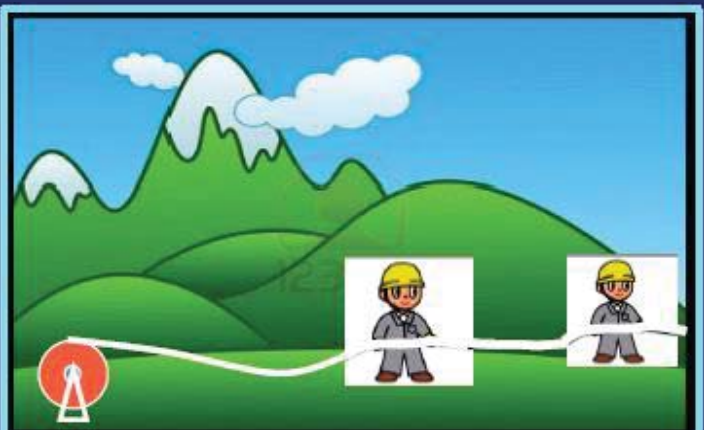
Optical cable laying by Helicopter
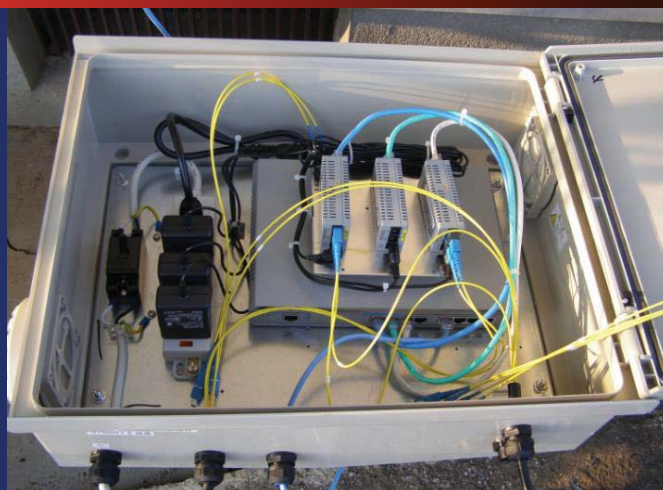## Cable dram with a disc brake
Possibility

Transmission Equipment (Outdoor)

Optical Cable

· **Anti-corrosion film**
· **Moisture absorber**
could be used to avoid air conditionng, where necessary.

Media converter
10 Gbps, 24dB (~80km) ; 6k US$/channel

A Project in Tohoku(Snowy Village), Japan, 2009-2010
7 people, 50Hs laying 2.3 km (20 min. for each fibre splice)

Cable laying time duration: 1 H/100m

Murata et.al., ITU Kaleidoscope 2011

A Project in Bhutan, March 2013
4-day construction for 1.2 km

Conducted by
(1) KDDI Foundation
(2) Ministry of Information and Communication (Bhutan)

Basic Health Unit (BHU)

Public schoo

Forest

Local Government Office (LGO)

Bridge

Aerial

ADSS Access point

Joint box

Direct burie

No BAD NEWS Heard as of Summer 2015

Pilot tests are being planned in Nepal

Kalapathar
5800 m

Mt. Everest

30 km

Namche Bazaar
3400 m

Center for ICT development, Nepal
KDDI Foundation, Japan
OCC, Japan
Global Plan, Japan
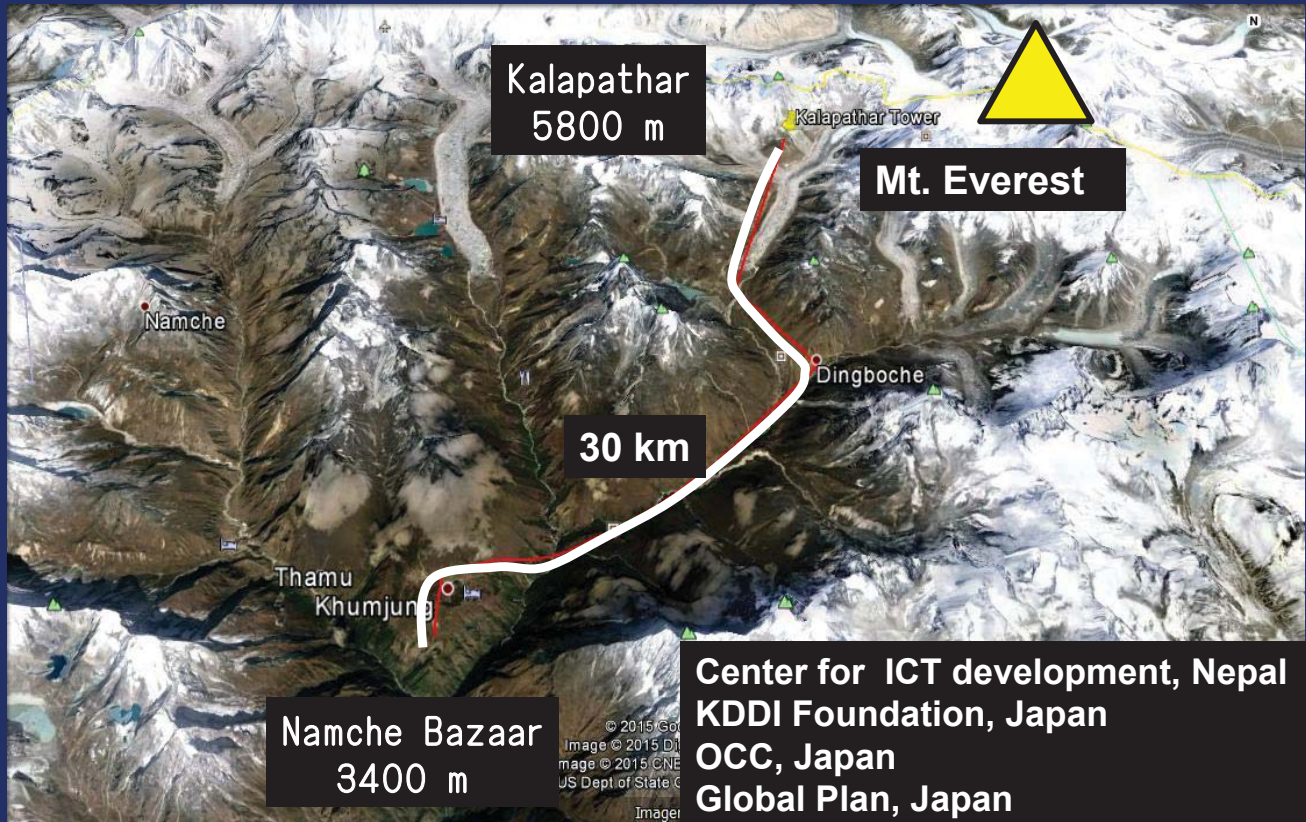
Summary (1)

"Broadband (25 Mbps)" will be soon necessary even in remote areas in developing countries

Satellite & Wireless are with limited bandwidth
< M bps, < G bps
Optical cable brings "real" broadband
>> T bps (10G, 10λ、10 Fibers = 1 Tbps)

Innovative Opt. Cable was proposed
Thin, lightweight, robust and easy-handling cable allows direct-surface installation in a DIY manner
➡ most cost-effective installation
➡ quick/nation- wide broadband backhauls

Summary (2)

The key is the metal pipe protecting fibers
against crush, rodent, moisture/water, high/low temp

ITU-T Recs. are being developed (SG5,15)
"Opt. cable for direct surface applications"
"Requiremenst for Low cost sustainable telecom in structure for rural areas in developing countries"

Pilot tests are being conducted and planned
Japan, Bhtan, Nepal, India (MP state). Multiple countries express interests in conducting pilot tests.

Thank you very much for your attention

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